INDUSTRIAL TECHNOLOGIES
INDUSTRY SECTOR
(Dollars in Thousands)

INDUSTRIES OF THE FUTURE (SPECIFIC)

Mission Supporting Goals and Objectives

Mission: The Industries of the Future (Specific) program supports cost-shared research, development, and demonstration (RD&D) in advanced technologies to improve the energy efficiency and environmental performance of America's most energy- and waste-intensive industries. To provide the best value and optimum use of public investments, the IOF (Specific) program focuses on eight major U.S. industries (aluminum, agriculture, chemicals, forest products, glass, metal casting, mining, petroleum, and steel) that collectively account for roughly 70 percent of industrial energy use and over 75 percent of manufacturing wastes.

Summary: The Industries of the Future (Specific) program consists of an integrated portfolio of RD&D projects on advanced technologies that will improve the energy efficiency and environmental performance of eight major energy-intensive industries. The RD&D projects focus solely on technologies that will bring broad energy benefits within the eight partner industries and that would not be developed by individual companies acting alone. By managing an integrated portfolio, we are able to identify and transfer some of the advanced technologies developed for one energy-intensive industry to applications in other energy-intensive industries and their supporting industries. The effort is further leveraged through our state-level Industries of the Future initiative, which capitalizes on partnerships among state agencies, industry associations, and regional agencies to broaden the reach of national technology investments and enhance state economic development.

The Industries of the Future (Specific) Program uses open, competitive solicitations as the primary mechanism to provide financial assistance to effective public-private partnerships, leverage Federal funds, and obtain substantial reductions in energy intensity for the eight partner industries. To facilitate the use of this mechanism, the solicitation process was streamlined and is now uniform across all Industrial technologies programs and sub-programs. Project management efforts are centralized to provide greater uniformity and more effective delivery of services. Competitive solicitations require the national laboratories to work in partnership with the private sector to submit proposals. To facilitate these partnerships, the Laboratory Coordinating Council works to inform the private sector about the unique and relevant capabilities of the national laboratories. This approach allows the national laboratories to contribute to partnership projects in which their unique capabilities provide value, as determined by their partners. The project selection process entails merit reviews by peer experts and careful evaluation of projected energy and economic savings. Prospective and retrospective peer review exercises are used to evaluate project performance and progress and to adjust support. To verify program performance and results, all commercialized technologies and the extent of their use by industry are tracked.

Long Term Goals and Objectives

Program Strategic Performance Goal
ER1-7: Specific Vision Industries
Specific Vision Industries R&D activities will develop a portfolio of energy saving technologies and methods that will catalyze reduced energy use in the eight energy-intensive "Industries of the Future" of 329 trillion Btu of annual savings in 2005 827 trillion Btu in 2010, and 2,377 trillion Btu in 2020, compared with the EIA conventional technology baseline.

Performance Indicators:
Number of technologies commercialized
Energy savings from Industrial technologies activities in partnership with industry
RD&D portfolio turnover of projects
Number of new Allied Partners
Number of energy-intensive plants impacted by the program
Number of internet information page views

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
! In FY 2001, 10 new technologies were commercialized from both the nine vision industries as well as the crosscutting programs. [1] ! In FY 2001, Industrial technologies helped industry save an estimated 262 trillion Btu of energy worth more than $1.6 billion.[2] ! Continued support for Industrial Assessment Centers operating at 26 participating universities that	! Commercialize 10 new energy efficient technologies in partnership with the most energy intensive industries. ! Complete 2 showcase demonstrations, at industry sights, of advanced energy efficient technologies. ! In FY2002, Industrial technologies will complete 20 new Allied Partnerships with energy intensive companies, trade organizations and other groups. ! Continue support for Industrial Assessment Centers operating at 26 participating	! In FY 2003, commercialize 10 new technologies. ! In FY 2003, help industry save more than 280 trillion Btu of energy worth at least $1.5 billion. ! In FY 2003, project turnover will represent 25% of the FY2002 RD&D project portfolio. ! FY 2003 Milestone: 2000 energy intensive U.S. plants will apply EERE technologies and services achieving up to a 15% improvement in energy productivity

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
will conduct approximately 650 combined energy, waste and productivity assessments.	universities that will conduct approximately 320 combined energy, waste, and productivity assessment days of service to manufacturing clients. ! In FY2002, help industry save more than 265 trillion Btu of energy worth more than $1.6 billion. ! Industrial technologies internet web sites will record over 5 million page views.	per plant. ! Industrial technologies internet web sites will record some 6 million page views. ! In FY 2003, Industrial technologies will complete 20 new Allied Partnerships with energy intensive companies, trade organizations and other groups

The following eight industry-specific programs contribute to accomplishing the overall Industrial technologies goals as measured by the performance indicators.

Forest and Paper Products Vision Goals and Objectives

- Reduce energy use in the forest products industry by 32 trillion Btu in 2005 (compared to conventional technology), 80 trillion Btu in 2010, and 258 trillion Btu in 2020.[a]
- By 2010, the forest products industry will implement advanced water removal technologies in papermaking resulting in an energy efficiency improvement of 10 percent in paper production.[b]

Steel Vision Goals and Objectives

- Reduce energy use in the steel industry by 30 trillion Btu in 2005 (compared to conventional technology), 71 trillion Btu in 2010, and 151 trillion Btu in 2020.
- Continue development of energy-efficient steel making technologies and prove the feasibility of a revolutionary steel conversion process that will significantly reduce energy intensity in the steel industry.[5]

[a] Forest Products industry energy savings related to black liquor gasification technology are included under Combustion/Gasification.

[b] This is a significant objective among others in the program. It will significantly contribute to achieving the energy savings identified in the preceding statement.

Aluminum Vision Goals and Objectives

- Reduce energy use in the aluminum industry by 17 trillion Btu in 2005 (compared to conventional technology), 76 trillion Btu in 2010, and 194 trillion Btu in 2020.
- By 2010, the aluminum industry will develop and implement advanced cell technologies, including inert anodes and wettable cathodes (27 percent reduction in energy consumption) and carbothermic reduction (32-38 percent reduction in energy consumption), for elimination of greenhouse gases and for net energy savings in primary aluminum production of 27 trillion Btu in 2010 and 68 trillion Btu in 2020.[5]

Metalcasting Vision Goals and Objectives

- Reduce energy use in the metal casting industry by 21 trillion Btu in 2005 (compared to conventional technology), 35 trillion Btu in 2010, and 75 trillion Btu in 2020.
- Enable major technical advances in the metal casting industry to implement new design techniques and practices to increase yield and reduce scrap and energy use. [5]

Glass Vision Goals and Objectives

- Reduce energy use in the glass industry by 15 trillion Btu in 2005 (compared to conventional technology), 31 trillion Btu in 2010, and 79 trillion Btu in 2020.
- Continue projects to develop advanced glass technology that will reduce the gap between actual melting energy use and the theoretical minimum by 50 percent.[5]

Chemicals Vision Goals and Objectives

- Reduce energy use in the chemical industry by 96 trillion Btu in 2005 (compared to conventional technology), 233 trillion Btu in 2010, and 786 trillion Btu in 2020.
- Continue separation and new process chemistry technology R&D to significantly increase energy efficiency.[5]

Mining Vision Goals and Objectives

- Reduce energy use in the mining industry by 41 trillion Btu in 2005 (compared to conventional technology), 76 trillion Btu in 2010, and 167 trillion Btu in 2020.
- By 2010, significantly reduce the energy intensity required to crush a short ton of rock.[5]

Agriculture Vision Goals and Objectives

- Through the increased use of bioproducts, reduce industrial energy use by 61 trillion Btu in 2005 (compared to conventional technology), 189 trillion Btu in 2010, and 545 trillion Btu in 2020.[a]
- As part of the Office of Energy Efficiency and Renewable Energy's (EERE) integrated Biomass Research and Development portfolio, develop leapfrog technologies that allow the emerging biobased products industry to achieve a fivefold increase in the market share by 2020 for chemicals and materials produced from biomass (crops, crop residues, trees, forest residues and other biomass waste).[5]

Supporting Industries Vision Goals and Objectives

- By 2010, significantly reduce the energy intensity of material forming and finishing processes.
- Reduce energy consumption in carburizing processes by 20 trillion Btu/year; in heat treatment of castings by 7 trillion Btu/year; and in welding processes by 20 billion Btu/year in aluminum alloy forging processes.[5]

No funding is requested for Petroleum Refining Vision in FY 2003; existing projects will be documented and closed down using FY 2002 funds.

[a]Benefits of the Agriculture IOF program include large substitutions of biomass feedstock for fossil fuel feedstock currently used in the production of chemicals. This displacement accounts for some 55-60% of the total primary energy saved by the program.

Annual Performance Results and Targets: *Forest and Paper Products Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Commercialized feedstock-to-products characterization tool and mechanical alternatives for chemical replacement in recycle mills.	• Commercialize the methane de-NO_x reburning process for wastewood, sludge, and biomass fired stoker boilers saving 1 trillion Btu per year by 2010 and 3 trillion Btu per year by 2020. • Demonstrate the use of low temperature plasma technology to control volatile organic compound emissions from an oriented strandboard plant that will save 0.5 trillion Btu per year by 2010 and 1 trillion Btu per year by 2020.	• Install prototype multiport cylinder dryers into existing full-scale dryers that will save 5 trillion Btu/year by 2010 and 18 trillion Btu/year by 2020. • Evaluate the use of high speed microwave treatment for rapid wood kiln drying in a commercial scale kiln that will save 1 trillion Btu/year by 2010 and 8 trillion Btu/year by 2020. • Demonstrate a suite of sensors in a wood drying kiln with wireless data transmission that will save 9 trillion Btu/year by 2010 and 35 trillion Btu/year by 2020. • Design and test full-scale, advanced black liquor nozzles in industrial applications that will save 23 trillion Btu/year in 2010 and 70 trillion Btu/year in 2020.

Annual Performance Results and Targets: *Steel Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Commercialized optical sensors and controls for improved basic oxygen furnace operations. • Commercialized recycling of waste oxides in steel making furnaces. • Made significant advancements in cost-effective, energy-efficient hot oxygen injection technology for the blast furnace, exposed automotive sheet steel surface quality technology, laser-assisted arc welding technology, magnetic gate system technology for molten metal flow control, nickel aluminide radiant heater technology, optical sensor for post-combustion control in electric arc furnace steel making, and non-chromium passivation techniques for electrolytic tin plate for the steel industry.	• Commercialize hot strip model to improve the steel product quality predictability, production yield, and energy efficiency. • Commercialize laser contouring sensor to enable optimized operation of steel making furnaces and reduce remelt and energy consumption. • Demonstrate an automated steel cleanliness tool using scanning electron. • Commercialize oscillating combustion technology in steel manufacturing processes.	• Expand the laser contouring sensor technology for ladle metallurgy and electric arc furnace market applications. • Complete R&D for sustainable steel making using biomass and waste oxides. • Complete evaluation of microwave de-oiling of steel mill waste sludges. • Complete conceptual definition of a revolutionary steel making process for the 21st century plant.

Annual Performance Results and Targets: *Aluminum Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Demonstrated conversion of spent potliner to products for the aluminum industry. • Conducted Showcase event at Alcoa's Spanish Fork facility, Utah, to highlight energy efficiency best practices as well as DOE-funded developments in sensors, furnace burner, and melter designs.	• Design and construct a 5K amp test cell for aluminum production, with an inert anode and wettable cathode and a novel cell design.	• Demonstrate an intelligent pot-room control system at a commercial smelter. • Demonstrate commercial viability of improved potliners with extended lifetimes to improve cell performance. • Determine the feasibility of carbothermic reduction technology to produce aluminum with 32-38 percent reduction in energy emissions. • Demonstrate a vertical flotation melter, with thermal efficiency 2.5 times that of a conventional furnace, at commercial scale on a plant floor.

Annual Performance Results and Targets: *Metalcasting Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Developed design guidelines for new feeding distance rules for carbon/low alloy steel castings. The guidelines were published and widely disseminated to the US steel casting industry. The potential benefit is an improved yield of up to 10%. • In-plant demonstration of new foundry melting practices developed for steel casting.	• Revise the Metal Casting Industry Vision to reflect new trends and challenges that the industry will need to address to achieve their 2020 vision goals. • Initiate development of new design rules for high alloy steel to increase yields and reduce scrap by 30%.	• New rapid solidification process (RSP) tooling technique developed for die casting industry will enable metal casters to reduce lead time, improve quality of casting, and save energy. • A new multi-layer system guideline will be available to the die casting industry. Die life is expected to be extended by at least 50%. • New development in radiographic standards for steel casting will enable a 30% reduction in scrap. • A new Computational Fluid Dynamics (CFD) Designer Software tool developed for advanced lost foam pattern production will be commercially available.

Annual Performance Results and Targets: *Glass Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Initiated commercial-scale demonstration of high-luminosity, low-NO_x burner technology and laser cutting of handglass for the glass industry. • Continued to incorporate furnace operating and design parameters in advanced glass furnace model.	• Begin installation of electrostatic cullet and batch preheating technology at a glass production facility. • Complete demonstration of high-luminosity, low NO_x burner technology. • Complete demonstration of laser-based cutting and finishing of handglass.	• Complete demonstration of electrostatic cullet and batch preheating technology at a glass production facility that will save 5 trillion Btu in 2010 and 8 trillion Btu in 2020. • Complete process development for recycling in-house fiberglass waste that will save 1 trillion Btu in 2010; potentially many times that amount if expanded to post-consumer fiberglass waste by 2020. • Validate advanced glass furnace model and hold a technology transfer workshop. • Complete development of laser-induced breakdown spectroscopy (LIBS) on-line sensor for improving production efficiency.

Annual Performance Results and Targets: *Chemicals Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Completed pilot test of advanced electrodeionization separation technology to reduce energy use by 4 trillion Btu per year by 2020.	• Begin implementation of the pressure swing absorption for product recovery technology in chemical plants to reduce energy use by 28 trillion Btu per year by 2020. • Complete pilot test of membrane for olefin recovery technology to reduce energy use by 24 trillion Btu per year by 2020.	• Complete multiphase computational fluid dynamics consortium projects to provide new design tools that will save 10 trillion Btu per year by 2020. • Complete R&D and pilot test of advanced alloys for ethylene production to reduce energy use by 107 trillion Btu per year by 2020.

Annual Performance Results and Targets: *Petroleum Refining Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Completed development of a portable hydrocarbon leak detector for the petroleum industry.	• Demonstrate portable hydrocarbon leak detector to identify fugitive emissions, which can lower costs, save energy, and reduce environmental impacts. • Demonstrate rotary burner for refinery process heating to save energy and reduce NO_x emissions to less than 10 ppm. • Close out program and transfer to industry portable hydrocarbon leak detector and rotary burner technology.	• No activities.

Annual Performance Results and Targets: *Mining Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Completed development of Three-Dimensional Simulation of Charge Motion in Semiautogenous Grinding (SAG) and Ball Mills for Energy Efficiency.	• Transfer the following successful projects to the private sector for commercialization: 1. Three-Dimensional Simulation of Charge Motion in Semiautogeneous grinding (SAG) and Ball Mills to reduce energy intensity 2. Dense-medium cyclone optimization 3. Novel rewatering aids for mineral and coal fines • Apply selective flocculation of fine mineral particles to many mining operations.	• Complete high-temperature superconductors to underground communication project to provide wireless underground communication, improve productivity and safety. • Continue development of advanced power and control for fuel cell mining vehicles to improve underground air quality and reduce energy use. • Complete horizon sensing technology to guide mining equipment and detect change in material to prevent the extraction of waste materials. • Commercialize fibrous monolithic composite as wear-resistant components to reduce downtime and energy use.

Annual Performance Results and Targets: *Agriculture Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Developed technologies to convert sugars from biomass to a valuable chemical (propylene glycol) used for anti-freeze, coatings, and other applications. Attracted commercial interest and a partnership for scale-up. (20 trillion Btu fossil fuel savings by 2020). • Advanced the development of soy-based 2-cycle engine oils for the emerging bio-products industry. • Demonstrated advanced electrodeionization separation technology for product purification at a pilot scale in trials at a Tate & Lyle HFCS plant.	• Cargill Dow LLC starts up the first full-scale PLA plastic manufacturing facility (300 million lbs./yr.) based on corn sugar as the feedstock. (200 trillion Btu fossil fuel savings by 2020.) • A 2-cycle, engine oil based on soy oil is commercialized for the emerging bioproducts industry. • Two new biobased polymer technologies advance to scale-up with industry partners committed to commercialization within two to three years.	• Commercialize two new biomass-based product technologies.

Annual Performance Results and Targets: *Supporting Industries Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Completed technology roadmaps for the advanced ceramics and process heating industries • The FY 2001 SI solicitation resulted in five technology projects for the heat treating, forging, and welding industries consistent with their respective technology roadmaps.	• The Metal Powder Industries Federation agrees to become an Allied Partner of the Industrial technologies Supporting Industries Program.	• Complete matrices of coincident research needs: 1. between supporting industries (SI-SI) 2. between SI and IOFs (SI-IOF) 3. (3) the SI-SI-IOF coincident research needs matrix. • Complete an energy and environmental metrics study of supporting industries including assessment of the strategic implementation of its results.

II. A. Funding Table: INDUSTRIES OF THE FUTURE (SPECIFIC)

Program Activity	FY 2001 Comparable	FY 2002 Comparable	FY 2003 Request	$ Change	% Change
Forest and Paper Products Vision	$11,799	$11,827	$11,827	$0	0.0%
Steel Vision	$10,365	$10,329	$10,329	$0	0.0%
Aluminum Vision	$10,876	$8,103	$8,103	$0	0.0%
Metalcasting Vision	$5,559	$5,357	$5,357	$0	0.0%
Glass Vision	$4,582	$4,572	$4,572	$0	0.0%
Chemicals Vision	$12,113	$14,458	$14,458	$0	0.0%
Petroleum Vision	$2,609	$2,800	$0	$-2,800	-100.0%
Mining Vision	$3,517	$5,119	$5,119	$0	0.0%
Agriculture Vision	$6,590	$7,259	$8,259	$1,000	13.7%
Supporting Industries.	$1,571	$1,600	$1,600	$0	0.0%
Technical / Program Management Support.	$2,250	$1,200	$1,991	$791	65.9%
Total, Industries of the Future (Specific)	$71,831	$72,624	$71,615	$-1,009	-1.3%

Note: Industries of the Future (Specific) includes $1,340 in FY 2001, $1,440 in FY2002, and $1,440 in FY2003 for the State Energy Program Special Projects State Grants. FY 2001Comparable column has been reduced by $559,000 for SBIR/STTR transfer .

II. B. Laboratory and Facility Funding Table: INDUSTRIES OF THE FUTURE (SPECIFIC)

	FY 2001	FY 2002 [a]	FY 2003 [a]	$ Change	% Change
Argonne National Laboratory (East)	$2,219	$2,243	$2,268	$25	1.1%
Lawrence Livermore National Laboratory	$400	$404	$409	$5	1.2%
Idaho National Engineering and Energy Laboratory	$796	$805	$814	$9	1.1%
Lawrence Berkeley National Laboratory	$707	$715	$723	$8	1.1%
Los Alamos National Laboratory	$1,000	$1,011	$1,022	$11	1.1%
National Renewable Energy Laboratory	$733	$741	$749	$8	1.1%
Oak Ridge National Laboratory	$4,458	$4,507	$4,556	$49	1.1%
Pacific Northwest National Laboratory	$1,042	$1,053	$1,065	$12	1.1%
Sandia National Laboratories	$2,378	$2,404	$2,430	$26	1.8%
All Other	$58,098	$58,741	$57,579	$-1,162	-1.9%
Total, Industries of the Future (Specific)	$71,831	$72,624	$71,615	$-1,009	-1.4%

[a] These dollars reflect an estimated distribution of Industrial technologies funds. They are not requested funds for individual laboratories.

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC)

Program Activity	FY 2001	FY 2002	FY 2003
Forest and Paper Products Vision	**Energy Performance** Research was targeted to improve energy efficiency and utilization, develop new techniques to extract maximum energy from waste streams, and increase the industry's fuel flexibility. One of the 12 energy reduction projects developed a wood chip microwave pretreatment technology to increase the yield, efficiency, and quality of Kraft pulping while decreasing chemical consumption and cooking temperatures. ($1,403)	**Energy Performance** Approximately 15 projects are being funded focusing on industrial energy efficiency and low-level heat recovery. Technical feasibility studies underway include: the development of an innovative energy efficient paper drying technology and an assessment of deposit formation in recovery boiler convection passes. Corrosion resistant materials are being developed for use in black liquor gasifiers. ($1,445)	**Energy Performance** Approximately 12 projects will focus on industrial energy efficiency and low-level heat recovery. Two technical feasibility studies will be completed: the development of an innovative energy-efficient paper drying technology and an assessment of deposit formation in recovery boiler convection passes. Continue development of corrosion-resistant materials for use in black liquor gasifiers. ($3,300)
	Environmental Performance Research was targeted to develop advanced pollution prevention technologies, decrease pollution abatement costs, and ensure manufacturing facilities are acceptable to industry workers and local communities. Ten projects were funded including the development of a Volatile Organic Compound (VOC) reduction model	**Environmental Performance** Approximately 15 projects are being funded focusing on developing advanced pollution prevention technologies, reducing pollution abatement costs, and ensuring manufacturing facilities are acceptable to industry workers and local communities. Several technical feasibility studies are being completed including the use	**Environmental Performance** Approximately 7 projects will focus on developing advanced pollution prevention technologies, reducing pollution abatement costs, and ensuring manufacturing facilities are acceptable to industry workers and local communities. The use of low temperature plasma technologies for elimination of volatile organic compound

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Forest and Paper Products Vision (cont'd)	that was used for emissions control in kraft mills. In addition, a technology to extract and collect VOCs from lumber drying processes was commercially demonstrated eliminating the need for expensive, energy-intensive emissions control technologies. ($2,508)	of paper mill by-products as an economical source of fiber reinforcement for ready-mixed concrete production, the optimization of oxygen bubble size for oxygen bleaching, and the development of a control strategy to reduce the emissions from wood dust burners and wood dryers. ($2,975)	emissions in the forest products industry will be demonstrated at a mill. ($1,727)
	Improved Capital Effectiveness Research was targeted to reduce the capital requirements per unit of production and sales. Twelve projects were funded and focused on system and process efficiency, materials of construction, and fabrication. An example was a tool to predict the corrosion rates in a kraft chemical recovery boiler. This tool decreased maintenance downtime and increased the safety of the chemical recovery boiler operation. ($1,315)	**Improved Capital Effectiveness** Approximately 12 projects are being funded focusing on systems and process efficiency, and materials of construction and fabrication. Feasibility studies are underway to: understand the formation of soluble scale fouling in concentrators and evaporators; evaluate energy efficient corregating technologies; and explore the use of natural gas rather than steam in paper drying. ($1,395)	**Improved Capital Effectiveness** Approximately 10 projects will focus on systems and process efficiency, and materials of construction and fabrication. Feasibility studies will be completed to: evaluate the use of borate autocausticizing in the recovery furnace eliminating the energy-intensive lime kiln causticizing; and to evaluate the use of wood drying hydrocarbon emissions as an auxiliary fuel for wood drying. ($2,200)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Forest and Paper Products Vision (cont'd)	**Recycling** Research was targeted to improve separation technologies, reduce energy usage and fiber deterioration, determine optimal combinations of recycled and virgin fibers, and expand the use of recycled products. Developed a new screening technology that reduced energy requirements by as much as 80% while improving the screen performance and reliability. Screening technologies are used to remove contaminants from recycled fiber. ($1,059)	**Recycling** Approximately 10 projects are being funded to reduce energy use and fiber deterioration in recycling, improve separation technologies, and expand the use of recycled fibers. Progress is continuing on the development of: pressure sensitive adhesives strong enough to remain intact through the pulping process and removable prior to paper making, and an automated, efficient, fast, autonomous waste paper sorting system. A technology to induce frothing from the top of a flotation deinking cell reducing the energy requirements for deinking is being demonstrated. ($1,475)	**Recycling** Approximately 7 projects will be funded to reduce energy use and fiber deterioration in recycling, improve separation technologies and expand the use of recycled fibers. Progress will continue on optimizing paper making drying processes to eliminate the irreversible loss in the ability of fibers to bond together for a second time when the fibers are recycled. ($1,200)
	Sensors and Controls Research was targeted to optimize mill operations, evaluate the characteristics of raw materials and final products, and detect emissions. One example of the projects in this area was the	**Sensors and Controls** Approximately 12 projects are being funded focusing on the development of actuators and control devices, process and product measurement and modeling, and data interpretation.	**Sensors and Controls** Approximately 5 projects will be funded focusing on the development of actuators and control devices, process and product measurement and modeling, and data interpretation.

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Forest and Paper Products Vision (cont'd)	development of an intelligent, vision-based apparatus for measuring properties on the wet end of the paper machine. Knowledge of wet-end process parameters improved the efficiency of water removal and reduced energy requirements in drying, the most energy-intensive paper making process. Eight projects were funded. ($3,877)	Specifically, an acoustic wave monitor for on-line measurement of the amount of corrosion and erosion in recovery boiler tubing is being developed as well as a model to diagnose and optimize control of continuous kraft pulp digesters. ($2,900)	A wireless microwave-based moisture sensor will be prototyped in a lumber drying kiln to optimize wood drying. ($2,200)
	Sustainable Forestry Research was targeted to optimize raw material supply by improving wood quality and increasing the yield of wood and fiber per harvested acre. Projects achieved reduced costs and increased efficiencies in manufacturing processes for pulp, paper, and wood products. Environmental benefits included increased rates of carbon sequestration in forests and forest products; reduced consumption of pulping and bleaching chemicals; and an increased supply of wood and manufacturing residues to	**Sustainable Forestry** Approximately 6 projects are being funded focusing on biotechnology, tree physiology, and sustainable soil productivity. Feasibility studies will be completed that evaluate techniques to improve the uniformity of fibers from loblolly pine with increased stem growth, and the use of molecular breeding to achieve desirable traits in juvenile loblolly pine. ($1,637)	**Sustainable Forestry** Approximately 8 projects will be funded focusing on biotechnology, tree physiology, and sustainable soil productivity. Continue studies to develop process models to predict the effect of forest management on growth and productivity of managed forest and understand the effects of intensive forest management. ($1,200)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Forest and Paper Products Vision (cont'd)	support renewable biomass energy. An example of this research included the development of a process to increase the stem growth rates of loblolly pine and study the molecular mechanisms of cell division to improve the efficiency of wood pulping. Five projects were funded. ($1,637) Participants included: The American Forest and Paper Association and their member companies, National Laboratories, the Institute of Paper Science and Technology, Pulp and Paper Education and Research Alliance members and partners, and others.	Participants include: The American Forest and Paper Association and their member companies, National Laboratories, the Institute of Paper Science and Technology, Pulp and Paper Education and Research Alliance members and partners, and others.	Participants include: The American Forest and Paper Association and their member companies, National Laboratories, the Institute of Paper Science and Technology, Pulp and Paper Education and Research Alliance members and partners, and others
Total, Forest and Paper Products Vision	**$11,799**	**$11,827**	**$11,827**
Steel Vision	**Production Efficiency** Research to reduce energy while lowering emissions and increasing	**Production Efficiency** Design and construct pilot plant demonstrating controlled thermo-	**Production Efficiency** Continue development of controlled thermo-mechanical

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Steel Vision (cont'd)	productivity in steel processing focused on a wide range of topics as identified in the Steel Industry Technology Roadmap. Key advances were made through improved sensing and control, increased use of by-products and recycling, and process improvement. These activities supported the industry's reduction of energy use by 19% while increasing its use of recycled steel and by-products to 66% of production. Collaborative R&D with the industry to develop improved, energy-efficient, low carbon dioxide emission, alternative iron and steel making processes were supported. R&D was conducted to improve the efficiency and productivity of the blast furnace, basic oxygen furnace, and electric arc furnace by developing modifications to hardware and operational practices. These modifications resulted from analyses and laboratory studies based on initial efforts in	mechanical processing for tubes and pipe. Demonstrate an automated steel cleanliness tool using scanning electron microscopy in a plant environment. Assess role of strip casting, based on the structure and properties of strip cast material. ($4,000)	processing technology for tubes and pipe. ($3,500)

Program Activity	FY 2001	FY 2002	FY 2003
Steel Vision (cont'd)	computational fluid dynamics and other design technologies leveraged from the Chemicals Vision. ($3,725)		
	Recycling R&D R&D on methods of increasing steel production based on recovery of iron units from all waste streams was conducted. R&D identified methods of increasing the efficiency of recycling steel from in-plant wastes. Processes were analyzed to identify ways to use other in-plant wastes as feedstock to reduce energy use. ($2,920)	**Recycling R&D** Identify technologies and practices to eliminate the risk of radioactive scrap entering the steel production cycle. Determine operating practices enhancing recycling of waste oxides in the steel making vessel. ($2,000)	**Recycling R&D** Complete R&D for recycling and re-use of basic oxygen furnace steel making slags through bench-scale testing. ($1,000)
	Environmental Engineering Developed methods for reducing the amount of consumables used in the steel making process. Consumables such as refractories can become an environmental disposal problem at the end of their lifetime. Efforts to reduce NO_x and CO_2 levels from the various unit operations in the steel mill	**Environmental Engineering** Complete long-term testing of an optical sensor for real-time measurement of gases in the EAF. Demonstrate low-NO_x, forced internal recirculating burner using by-product gases. ($1,500)	**Environmental Engineering** Complete R&D for sustainable steel making using biomass and waste oxides. Complete evaluation of microwave de-oiling of steel mill waste sludges. ($1,500)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
	continued. ($3,240)		
Steel Vision (cont'd)			
	Feasibility Studies on Innovative Steel Production	**Feasibility Studies on Innovative Steel Production**	**Feasibility Studies on Innovative Steel Production**
	Significant crossovers of technologies between Electric Arc Furnace (EAF) and Basic Oxygen Furnace (BOF) steel making indicated that there are significant opportunities to improve the steel making process by, at a minimum, combining and optimizing the best features of both. The development of a recuperated, continuous (as opposed to batch) steel making process could result in saving half the energy currently used in the steel conversion/melting operation. These activities initiated feasibility and design studies to develop a new steel conversion process. ($480)	Steel Cup Challenge: continue activities to develop a new steel conversion process based on prior year studies. The expected outcome is to prove the fasibility of the new steel conversion process for future prototype development consideration. ($2,829)	Select and initiate R&D on a revolutionary steel conversion process based on the results of the feasibility studies. ($4,329)
	R&D participants in the Steel Vision included: American Iron and Steel Institute (member and associate member companies),	R&D participants include: American Iron and Steel Institute (member and associate member companies), Steel Manufacturers	R&D participants include: American Iron and Steel Institute (member and associate member companies), Steel Manufacturers

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Steel Vision (cont'd)	Steel Manufacturers Association (member and associate member companies), national laboratories, and universities.	(member and associate member companies), national laboratories, and universities.	(member and associate member companies), national laboratories, and universities.
Total, Steel Vision	**$10,365**	**$10,329**	**$10,329**
Aluminum Vision	**Primary Production Technologies** The accelerated research program was continued for the development and implementation of an advanced cell with the potential to reduce energy consumption by 27% and greenhouse gas emissions by 5.5 million metric tons of carbon equivalent over a "business as usual" scenario. Implementation of an advanced cell of this kind would be the most significant advancement in aluminum production technology since the development of the Hall-Heroult process in 1886. Scale-up of advanced cell development and testing was delayed due to the	**Primary Production Technologies** Continue preparations to demonstrate, in full-scale cell tests, commercial viability of potliners containing additives for improved performance and life. Develop control strategy using sensors for aluminum smelting cells and continue to prepare for scale up of advanced cell technologies. ($4,603)	**Primary Production Technologies** An intelligent pot-room control system will be demonstrated at a commercial smelter. An innovative design production cell, with an inert anode and wettable cathode, will be pilot tested at 5000 amps at a production facility. The technical and economic viability of carbothermic reduction technology to produce aluminum with 32-38% reduction in energy will be determined by laboratory-scale reactor tests. ($4,603)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Aluminum Vision (cont'd)	energy crisis and resulting shutdown of much of the primary aluminum production capacity in the U.S. Feasibility of using fuel cell technology for development of a non-consumable anode was evaluated, and a control strategy using sensors was developed for aluminum smelting cells. A pilot scale demonstration of saltcake recycling technology was completed. Laser and optical techniques for scrap sorting were evaluated. ($7,185)		
	Semi-Fabrication Technologies Year-long tests of potlinings containing additives for improved performance and life were initiated in full-scale industrial cells. ($3,691) Participants: R&D participants include Alcan, Alcoa Inc., Applied Industrial Solutions, Inc., Argonne National Laboratory, Century Aluminum, Cornell University,	**Semi-Fabrication Technologies** Develop new process techniques to reduce oxidative losses in aluminum by 50% and stress cracking by 60%. Demonstrate dross reductions of 60% on an industrial reverberatory furnace by an advanced combustion system. Assess spray rolling of aluminum strip at lab scale and 2X scale-up. Over 80 different industrial,	**Semi-Fabrication Technologies** A high watt density immersion heater will be demonstrated for energy efficient aluminum melting. A low dross combustion system will be demonstrated at pilot and commercial scale. Quenchant cooling will be modeled and improved for the plant floor. A vertical flotation melter will be demonstrated commercially.

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Aluminum Vision (cont'd)	EMEC Consultants, Energy Research Company, Gas Research Institute, Kaiser Aluminum Company, Michigan Technological, NSA Aluminum, Oak Ridge National Laboratory, Siemens Westinghouse Co., The Ohio State University Research Foundation, West Virginia University.	university, and laboratory partners will participate in the partnership in 2002. ($3,500)	Over 80 different industrial, university, and laboratory partners will participate in the partnership in 2003. ($3,500)
Total, Aluminum Vision	**$10,876**	**$8,103**	**$8,103**
Metalcasting Vision	Continued a balanced portfolio of high-priority research responsive to the goals and challenges identified in the metalcasting vision and metalcasting technology roadmap. Each of the projects is cost-shared 50% with industry partners. Over		Approximately 21 research projects will be funded. All projects will be 50% cost-shared with industry partners.

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Metalcasting Vision (cont'd)	220 industry partners in at least 30 states work on program-funded research projects. Continued research projects from previous year's competitive solicitations include the following educational institutions and national laboratory: University of Alabama-Birmingham, University of Alabama-Tuscaloosa, Case Western Reserve University, Colorado School of mines, University of Iowa, Iowa State University, Mississippi State University, University of Missouri-Rolla, Ohio State University, Penn State University, Oak Ridge National Laboratory (ORNL), Tri-State University (Indiana), University of Tennessee, Worcester Polytechnic Institute, and Pacific Northwest National Laboratory (PNNL).		
	Manufacturing Technologies Research continued to develop advanced casting technologies for producing high-quality castings.	**Manufacturing Technologies** Develop new models and alloy properties for semisolid metal processing (SSM), new models,	**Manufacturing Technologies** The Program is supporting research in advanced manufacturing technologies and processes to

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Metalcasting Vision (cont'd)	Research focused on advanced lost foam casting technology and binders (chemicals that hold sand molds together) for iron and steel casting. Technical challenges included the removal of gaseous residuals during metal pouring, better and cheaper foam materials, and rapid prototyping of the patterns. In addition, research continued in semi-solid metals processing (SSM) to develop models and characterize material properties in order to produce higher integrity, high volume, lightweight castings, while enabling new castings with thinner walls and reduced machining requirements. ($2,312)	and pattern materials in lost foam research and Best Practices guidelines, minimizing die distortion, reducing scrap rate, and improving productivity. ($2,359)	improve the energy efficiency of metal casting process. These research efforts include the development of new design rules and foundry practices for high alloy steel casting models to increase the yield and reduce scrap by 30% in steel casting. The research effort will also explore unconventional techniques to increase yields by an additional 10%. ($2,359)
	Materials Technologies Activities focused on advancing the use of new and improved materials to produce defect-free, high-quality	**Materials Technologies** Complete materials research on the castability on aluminum die casting alloys, enabling new applications	**Materials Technologies** The Program is supporting research in this area to give a better fundamental understanding of the

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Metalcasting Vision (cont'd)	casting while achieving longer life for mold, refractory lining, and casting dies. Continued to focus on innovative research to develop advanced coatings capable of extending the useful life of casting dies tenfold in comparison with current conventional methods. In addition, R&D efforts continued on technologies needed to consistently produce machinable, high-strength, then-walled gray and ductile iron castings. ($1,822)	of advanced die casting alloys and develop new heat treating guidelines to enable U.S. die casters to extend the life of die materials by 20-30%. ($2,000)	performance and material properties of casting materials. An example of these projects is the Semi-Solids Metals Processing (SSMP) at Worcester Polytechnic Institute (WPI). The goal of this project is to develop low-cost, energy-efficient, high quality SSM feedstock. Demonstration of a multi-layer coating system to extend the die life of die casting dies will be completed. ($2,000)
	Environmental Technologies A balanced portfolio included critical research needed to develop design guidelines for thin-wall iron castings, on the order of 3-5 mm thickness, will enable automotive engineers to design car components with significant reductions in metals required, resulting in tremendous reductions in energy use and environmental burden in both casting production and	**Environmental Technologies** Make available non-incineration technique as an alternative for ferrous foundries to reduce VOC emissions. ($300)	**Environmental Technologies** Complete the development of technical performance data and guidelines needed to advance the beneficial reuse of spent foundry sand. Information developed from the project will be disseminated widely for industry adoption through industry workshops, professional committees, and other media.

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
	transportation fuel. ($475)		There are over 320 industry partners in 35 states providing cost shares to the research projects. ($300)
Metalcasting Vision (cont'd)	**New Casting Applications** New design tools and improvements in casting techniques and models were developed to enable new applications of advanced casting technologies, which will reduce energy use, reduce cost, and minimize waste generated. New techniques developed for metal handling will enable U.S. metalcasters to reduce casting defects, improve quality of castings by removing/minimizing oxide defects that require weld repair, and improve the competitiveness of the U.S. metalcasting industry. ($950)	**New Casting Applications** New design tools, improvements in casting techniques and models will be developed to enable new applications of advanced casting technologies and reduce casting defects and improve quality of castings. ($698)	**New Casting Applications** The Program is supporting research to develop new design tools and improve casting techniques to enable new applications of advanced energy efficient casting technology. Material characterization effort to determine the detrimental effort of welding on the corrosion performance of duplex stainless steels will be completed. New Rapid Solidification Process (RSP) tooling technique developed for die casting industry. ($698)
Total, Metalcasting Vision	**$5,559**	**$5,357**	**$5,357**

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Glass Vision	**Production Efficiency** Continued modeling of refractories (the main structural materials in glass melting furnaces) and improvement of combustion and melting technology. Transferred fundamental knowledge of glass properties to industry. Demonstrated advanced sensor technologies, handglass cutting, and process control technique for auto glass. Initiated feedstock measurement and control technology. Implemented national laboratory-based GPLUS program. ($1,832)	**Production Efficiency** Continue modeling of refractory corrosion. Transfer handglass cutting technique to specialty glass industry. Continue development of feedstock measurement and control technology. Continue sensor and process control efforts. Continue implementation of national laboratory-based GPLUS program. ($1,450)	**Production Efficiency** Complete refractory corrosion modeling efforts. Begin demonstration of feedstock measurement and control technology. Continue to implement national laboratory-based GPLUS program. ($950)
	Energy Efficiency/Conservation Continued activities to validate new and existing furnace models. Initiated new technologies that support innovative glassmaking and improved heat recovery. Finalized design of glass furnace	**Energy Efficiency/Conservation** Continue activities to validate a three-dimensional glass furnace simulation model. Continue to develop new technologies that support innovative glassmaking and improved heat recovery.	**Energy Efficiency/Conservation** Complete efforts to validate a three-dimensional glass furnace simulation model that more accurately represents the melting process. Continue to develop new technologies that support

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Glass Vision (cont'd)	combustion and melting research facility. Supported activities to promote energy management practices. ($1,155)	Conceptual design of oxy-fuel glass research facility provided to the industry. Support activities to promote energy management practices. ($1,650)	innovative glassmaking and improved heat recovery. Award projects from industry solicitation for improved energy and production efficiency and environmental performance in glassmaking and advanced processing of engineered glasses. Support activities to promote energy management practices. ($2,200)
	Environmental Protections and Recycling	**Environmental Protections and Recycling**	**Environmental Protections and Recycling**
	Demonstrated high-luminosity, low-NO_x burner for glass furnaces. Initiated technology to recover and recycle in-process fiberglass waste. Initiated technology to identify and control emission management mechanisms from glass melting furnaces. Supported cullet re-use systems. ($755)	Refine and transfer high-luminosity, low-NO_x burner technology for glass furnaces to industry. Continue to develop technology to recover and recycle in-process fiberglass waste; identify and control emission management mechanisms from glass melting furnaces. Support development of cullet re-use systems. ($840)	Produce recycled materials from in-process fiberglass waste for further testing; design and test a prototype instrument to minimize volatilization mechanisms in glass melting furnaces. Begin testing of cullet re-use systems. ($900)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Glass Vision (cont'd)	**Innovative Uses**	**Innovative Uses**	**Innovative Uses**
	Initiated new technology for improved coating of flat glass. Continued innovative glass compositions and processes to enhance performance and new material-design models to improve properties. ($685)	Continue to develop new technology for improved coating of flat glass. ($525)	Conduct pilot-scale testing of improved technology for coating flat glass. ($400)
	Deployment Logistics	**Deployment Logistics**	**Deployment Logistics**
	Conducted technical workshops on coatings and combustion. Reviewed technology roadmap assessment. ($155)	Update technology roadmap. ($107)	Conduct technical workshops on cullet recycling and energy management. Reassess technology roadmap to refine priorities. ($122)
	Participants included: Visteon, PPG, Techneglas, Owens Corning, Gallo Glass, Fenton Art Glass, BOC Gases, Accu-Tru International, Gas Technology Institute, Alfred University-Center for Glass Research, Mississippi State University, Los Alamos National Laboratory, Oak Ridge National Laboratory, Sandia National Laboratories, Pacific	Participants include: Visteon, PPG, Techneglas, Owens Corning, Gallo Glass, CertainTeed, Fenton Art Glass, BOC Gases, Energy Research Company, Gas Technology Institute, Alfred University-Center for Glass Research, Mississippi State University, Los Alamos National Laboratory, Oak Ridge National Laboratory, Sandia National	Participants include: Visteon, PPG, Techneglas, Owens Corning, Gallo Glass, Fenton Art Glass, CertainTeed, BOC Gases, Energy Research Company, Gas Technology Institute, Alfred University-Center for Glass Research, Mississippi State University, Los Alamos National Laboratory, Oak Ridge National Laboratory, Sandia National

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Glass Vision (cont'd)	Northwest National Laboratory, Argonne National Laboratory, Ames Laboratory, National Energy Technology Laboratory, and the States of West Virginia, Ohio, and Pennsylvania.	Laboratories, Pacific Northwest National Laboratory, Argonne National Laboratory, Ames Laboratory, National Energy Technology Laboratory, and the States of West Virginia, Ohio, Pennsylvania, Florida, and North Carolina.	Laboratories, Pacific Northwest National Laboratory, Argonne National Laboratory, Ames Laboratory, and the States of West Virginia, Ohio, Pennsylvania, Florida, Indiana, and North Carolina.
Total, Glass Vision	**$4,582**	**$4,572**	**$4,572**
Chemicals Vision	**New Chemical Sciences and Engineering** Continued R&D to support *Technology Vision 2020* in separations, catalysis, computational chemistry, and chemical synthesis pathways. Demonstrated advanced electrodeionization separation technology in pilot-scale–potential energy savings of 4 trillion Btu per year by 2020. Conducted full-scale demonstration of novel membrane-based process to recover propylene	**New Chemical Sciences and Engineering** Continue advanced separation technology R&D to decrease the over 2 quadrillion Btu per year of energy required to separate, process, and refine chemicals. ($6,358)	**New Chemical Science and Engineering** Continue separation technology R&D to more efficiently separate, process, and refine chemicals. Develop new process chemistry technologies that will significantly improve chemical reactions and product yields to increase energy efficiency in key chemical product chains by more than 30%. ($6,358)

Program Activity	FY 2001	FY 2002	FY 2003
Chemicals Vision (cont'd)	from propane–energy savings from displaced feedstock are estimated to be 23 trillion Btu/year by 2020. ($9,863)		
	Manufacturing and Operations Conducted solicitation to support development and implementation of energy saving technologies identified in technology roadmap for manufacturing and operations. Continued R&D to develop: new materials for high-temperature, corrosive environments; improved models for predicted material behavior; new/improved materials; and better joining and fabricating methods. ($975)	**Manufacturing and Operations** Partner with American Institute of Chemical Engineers (AIChE) to develop energy metrics for 5 chemical plants to incorporate new best practices and emerging technologies. ($400)	**Manufacturing and Operations** Expand development of energy metrics for major chemical processes with AIChE. Complete pilot test for new alloy for ethylene production that will save 107 trillion Btu/year by 2010. Initiate Chemical Industry Vision 2020 led project to develop innovative energy supply systems for chemical process technologies to save 200 trillion Btu/year by 2020. ($400)
	Computational Technologies Continued advancement of multi-phase CFD consortium projects. Computational technologies can optimize process energy requirements and shorten the lead time from research to plant design	**Computational Technologies** Continue advancement of multiphase computational fluid dynamics consortium projects to reduce energy consumption and downtime. ($1,000)	**Computational Technologies** Complete multiphase computational fluid dynamics consortium projects that will save 10 trillion Btu per year by 2020. ($1,000)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Chemicals Vision (cont'd)	by several years. Conducted R&D on simulating industrial scale turbulent gas solid flows and adapting multi-phase computational fluid dynamics to fluid-particle processes. Completed installation of experimental test loop. Completed improvements of MIFX software code. Annual energy savings are estimated to be 100 trillion Btu/year by 2020. ($1,275)		
	Chemical Synthesis Technologies	**Chemical Synthesis Technologies**	**Chemical Synthesis Technologies**
	No funds requested. ($0)	Develop new process chemistry and catalysis technologies that will significantly improve chemical reactions and product yields to increase energy efficiency in key chemical product chains by more than 30%. ($6,700)	Develop new process chemistry and catalysis technologies that will significantly improve chemical reactions and product yields to increase energy efficiency in key chemical product chains by more than 30%. ($6,700) Participants include: Praxair, Air Products, Honeywell Reaction Engineering, Sandia National Laboratory, Dupont, Dow Corning, Exxon Chemicals, Chevron, Fluent, Aspen Technology, OLI Systems,
Chemicals Vision			

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
(cont'd)			AIChE, University of Texas, Rohm and Haas, NTEC, Membrane Technology Research, Argonne National Laboratory, and Oak Ridge National Laboratory.
Total, Chemicals Vision	**$12,113**	**$14,458**	**$14,458**
Petroleum Vision	The Petroleum Industry Vision and Roadmap focuses on the environment, process improvement, and energy efficiency. Initiated projects selected in FY 2000 solicitation to address downstream petroleum needs. Continued cost-shared projects including energy saving separations technologies to develop membranes to replace distillation, global on-stream inspection, gas chromatograph controller to improve process efficiency, a rotary burner to significantly reduce NO_x in heaters and boilers while lowering energy use, broadening enzyme selectivity, and improving	Complete second year of 3 year, cost-shared projects on separations membranes, gas chromatograph controller, global on-stream inspection, rotary burner and biodesulfurization initiated in FY 2001. Initiate several new cost-shared projects to help small refineries improve process energy efficiency. ($2,800)	Close out projects previously funded. No funds requested. ($0)
Petroleum Vision			

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
(Cont'd)	activity for biological desulfurization. ($2,609)		
Total, Petroleum Vision	**$2,609**	**$2,800**	**$0**
Mining Vision	**Characterization and Processing** Leveraged research funds with industrial cost sharing as well as state and other Federal funding to support the industry's vision. Facilitated interagency roadmaps for technologies such as exploration and excavation. Developed technologies for resource characterization, mining, and processing that demonstrate accountable benefits for the U.S. mining industry. Technologies funded include advanced minerals characterization, integrated mining systems, and low-energy metals processing. These technologies are expected to save over 5 trillion Btu annually. ($3,517) Partners included major mining and	**Characterization and Processing** Leverage research funds with industrial cost sharing as well as state and other Federal funding to support the industry's vision. Facilitating update of industry vision and roadmaps. Initiate funding in response to the laboratory-led processing roadmap. The Mining IOF will continue research on crosscutting technologies in mining such as sensors, materials, and other process and technical advances to improve energy efficiency and productivity in mining. The mining IOF will facilitate an education roadmap targeting university engineering enrollment and university-based research including graduate program research.	**Characterization and Processing** The Mining Industry of the Future program will leverage funds with industry cost-share to fund new industry-led projects related to the mining and exploration roadmap. Continue planned work on multi-year R&D projects that were awarded in previous years. Initiate work on the development of advanced mineral processing technologies and resource characterization, which is an additional high priority area identified in the industry vision and the associated roadmaps. Commercialize "Oil Pro" and other projects which have ended or are ending this year. These projects reflect the goal of our vision to develop low cost and efficient

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Mining Vision (cont'd)	mineral processing companies, equipment manufacturers, universities, and national laboratories.	Continue research on advanced mining and processing technologies to support industry needs. ($5,119) Partners include major mining and mineral processing companies, equipment manufacturers, universities, and national laboratories.	production and to develop advanced products. ($5,119) Partners include many mining and mineral processing companies, equipment manufactures, universities, and national laboratories.
Total, Mining Vision	**$3,517**	**$5,119**	**$5,119**
Agriculture Vision	**Biobased Industrial Feedstocks Initiative** Participated fully in implementing the new Executive Order on Biobased Products and Bioenergy. Progress in achieving industry's ambitious target of a fivefold increase in market share for renewable bioproducts began to build momentum. Supported project R&D from first 2 solicitations and issued new request for proposals that build on the "lessons learned" from earlier	**Biobased Industrial Feedstock Bioenergy/Bioproducts Initiative** Implement Agriculture IOF as an integrated part of the EERE Biomass R&D portfolio. Continue to support the 18 active Agriculture IOF R&D projects, and the 8 multi-disciplinary biobased product technology university graduate education programs, helping to ensure well-focused efforts and achievement of key milestones.	**Biobased Industrial Feedstock Bioenergy/Bioproducts Initiative** Implement Agriculture IOF as an integrated part of the EERE Biomass R&D portfolio. The 12 active R&D projects will continue to focus on innovative technology for the use of biomass as feedstock for chemicals and materials and result in less processing energy used to produce these products compared to their petroleum feedstock alternatives.

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Agriculture Vision (cont'd)	solicitations. Emphasized projects that showed clear linkages across the highest priorities in the roadmap. Projects emphasized an integrated and coordinated approach to make better use of public and private funding and accelerated progress toward percent of the market for chemical feedstocks from plant material by 2020. Solicitation process broadened our base of partners in the agricultural, chemical, and forestry communities. An overwhelming response of 28 excellent proposals from talented multi-partnered research collaborations was received. Six outstanding projects were funded. Continued to provide support to those higher education institutions with winning proposals for new, multidisciplinary approaches from FY 2000 and issued a second solicitation to broaden participation in the Renewables 2020 education initiative.	Expect the successful start-up of Cargill Dow's first large-scale (300 Mlbs./yr.) polyactic acid (PLA) plastics plant in Blaire, Nebraska, based on corn sugar as the feedstock. This facility will be expanded to include the fermentation of the lactic acid required as well. Ongoing projects funded by the Agriculture IOF and the DOE Biobased Products and Bioenergy Initiative should further reduce the cost and increase the energy efficiency of this technology and enable as much as 8 billion lbs. PLA market by 2020. Expect the commercial introduction of a soy-oil based, 2-cycle engine oil and 2 other projects should result in a firm commercial commitment with a target date within 2 years for biobased polymers and/or solvents. The Agriculture IOF program will leverage, participate, and integrate with the planned EERE-wide	These efforts include: novel separations technology, the production of plastics, foams, adhesives, and coatings based on sugars and vegetable oils, lower cost and energy use in harvesting, pre-processing and biomass storage, and the modification of crops to reduce the cost, processing requirements and energy use in the use and conversion of the crops to biobased products. It is expected that 2 of these current and/or past projects will include scale-up of the technology to pilot scale demonstrations with industry partners and 1 or 2 commercializations in the areas of new biobased polymers or solvents. Initial technology breakthroughs are expected in plant sciences relative to improved crop composition for biobased products, as well as novel, lower cost, less energy-intensive harvesting and storage technology.

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Agriculture Vision (cont'd)	Sought deeper collaboration on R&D decisionmaking and public outreach with other parts of the Department of Energy, the Department of Agriculture, and other pertinent agencies in the Federal government as well as state governments. Novel electrodeionization (EDI) technology for lower cost, lower capital, less energy-intensive purification of HFCS was successfully demonstrated in a pilot trial at a Tate&Lyle plant. This technology can have wide application in the biobased product and chemical industry. A soy-based, 2-cycle engine oil moved to full engine testing. Firm commercial interest in new technology to produce propylene glycol (for anti-freeze and polymer coating applications) from glucose from corn. ($6,590)	biobased products and bioenergy solicitations funded through OPT and Industrial technologies. These solicitations will focus on biorefinery technology resulting in the production chemicals as well as fuels and/or power. It will also leverage related Industrial technologies IOF and other programs such as the Forest Products IOF, the Chemical IOF, and Financial Assistance to add to the portfolio of R&D related to biobased products. This has already proven to be valuable and synergistic. The FY 2002 budget will be used to fund existing projects. ($7,259) Participants include: National Corn Growers Association, American Soybean Association/United Soybean Board, National Association of Wheat Growers, American Forest and Paper Association, Corn Refiners Association, National Association of State Universities and Land-	The Agriculture IOF program will leverage, participate and integrate with the EERE-wide biobased products and bioenergy solicitations for efforts that benefit bioproducts as well as bioenergy focusing on biorefinery pertinent research. It will also leverage related Industrial technologies IOF and other programs such as the Forest Products IOF, the Chemical IOF, and Financial Assistance to add to the portfolio of R&D related to biobased products. No new Agriculture IOF R&D solicitations will be issued. Appropriate adjustments will be made to existing R&D project funding based on their performance using milestone targets. The existing university grants funding may be increased and/or a new solicitation in this area will be offered to continue to expand and improve the multi-disciplinary graduate programs in biobased

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Agriculture Vision (cont'd)		grant Colleges, Cargill, ADM, Dow Chemical Co., Dupont, Eastman Chemical, BF Goodrich, Rohm and Haas Co., Amalgamated Research Inc., Biomass Agriculture Products (B/MAP), Genencor International, Cargill Dow Polymers, PNNL, INEEL, ANL, ORNL, NREL, and many universities.	product/bioenergy technology at 8 universities. ($8,259) Participants include: National Corn Growers Association, American Soybean Association/United Soybean Board, National Association of Wheat Growers, American Forest and Paper Association, National Association of State Universities and Land-grant Colleges, Cargill, ADM, Dow Chemical Co., Dupont, Eastman Chemical, BF Goodrich, Rohm and Haas Co., Genencor International, and Cargill LLC, Metabolix, B/MAP, Vertec Biosolvents, BCI, Altus Biologics, Amalgamated Research Inc., PNNL, INEEL, ANL, ORNL, NREL, and a wide array of universities.
Total, Agriculture Vision	**$6,590**	**$7,259**	**$8,259**

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Supporting Industries	Issued competitive solicitation to support technology R&D not covered by other IOF-specific programs that can help provide significant cost and energy savings. For instance, forging and heat treating industries directly support the steel and aluminum industries and have developed visions and roadmaps that can be correlated to the priority needs of the Industries of the Future. ($1,571)	Continue work funded for FY 2001 for developing systems for saving energy in heat treatment of castings; novel materials and process designs for thermally-stable tool and die steel; strategies for the die material and surface coatings; energy conserving forging technology applicable to aluminum alloys; and a novel methodology for optimizing the welding process. ($1,600) Participants include: Forging Ind. Assoc.(FIA), Lincoln Elec. Co., Worcester Polytech. Inst. (WPI), Center for Heat Treating Excellence (CHTE), Air Products and Chemicals, Boycote Thermal Processing, Caterpillar, Deere & Co., Eclipse, GMC, Houghton Int'l, Ipsen Int'l, AMCAST Ind.Corp., ALCOA, UES Software, Kolene Corp.,Pratt & Whitney, Surface Combustion, Timken Co., several universities and national labs.	Continue work funded for: heat treatment control algorithm; effects of operating parameters on welds; effects of infrared heating on forging stock's mechanical properties; experiments to determine energy and environmental envelopes of innovative die materials and lubricants; and computational models and process studies to design alloys with improved carburization response ($1,600)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2001	FY 2002	FY 2003
Total, Supporting Industries	**$1,571**	**$1,600**	**$1,600**
Technical/Prog. Management Support	Provided critical technical and program management support services. ($2,250)	Provide critical technical and program management support services. ($1,200)	Provide critical technical and program management support services. ($1,991)
Total, Technical/Prog. Management Support	**$2,250**	**$1,200**	**$1,991**
TOTAL, INDUSTRIES OF THE FUTURE (SPECIFIC)	**$71,831**	**$72,624**	**$71,615**